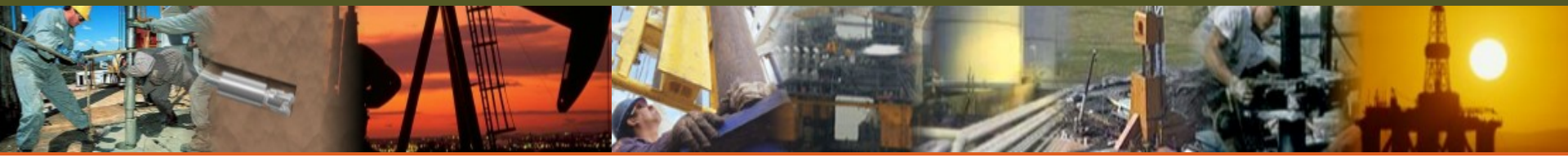
Drilling Equipment



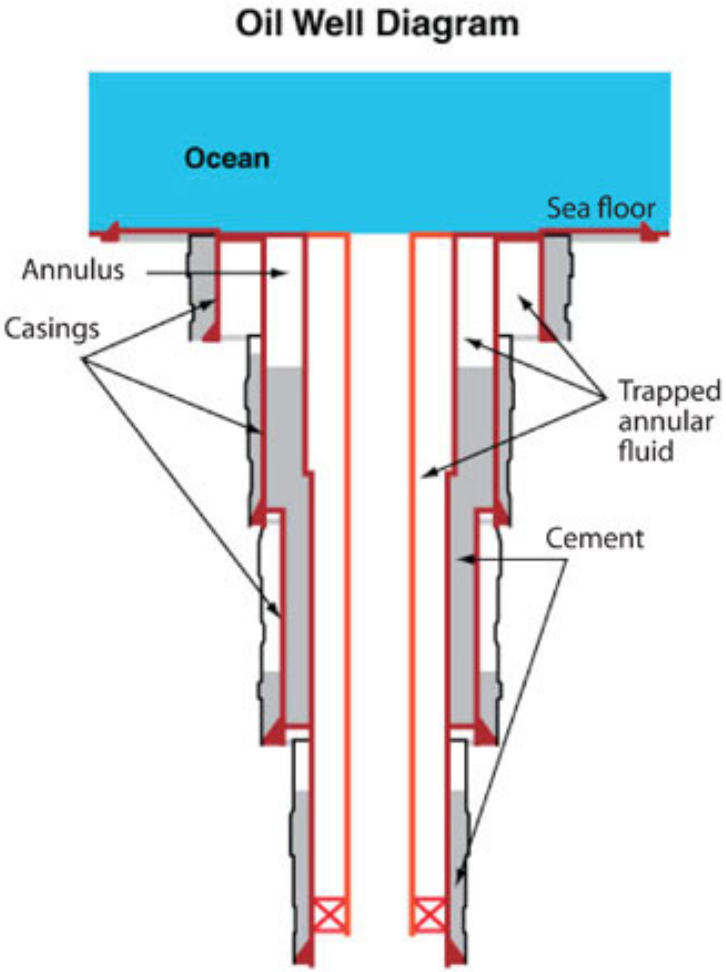
IN THE NAME OF GOD

- MOHAMMAD MAHDI SEMYARI

- MASTER DEGREE OF DRILLING
- 2015 TILL TODAY TOOLPUSHER OF JACK-UP RIG

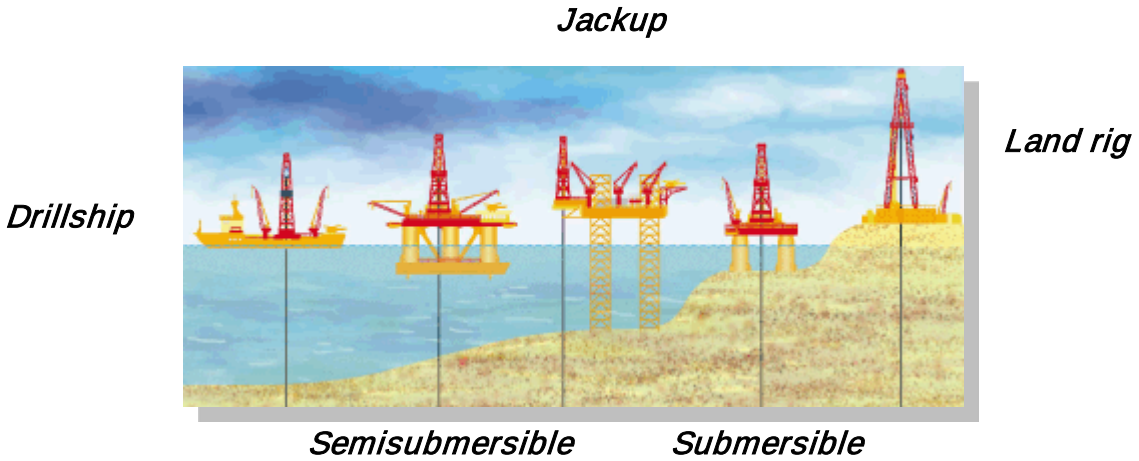
Well structure

- Conductor – surface csg – Intermediate csg - production



Rig:

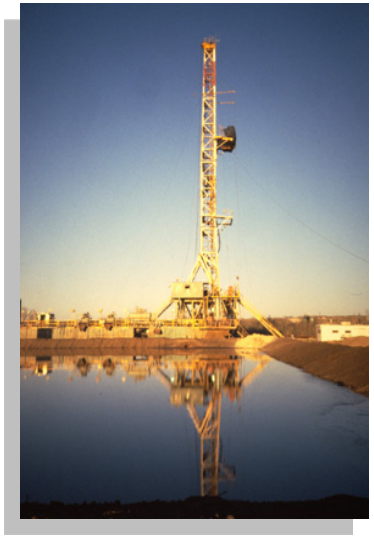
The machine used to drill a wellbore. In onshore operations, the rig includes virtually everything except living quarters. Major components of the rig include the mud tanks, the mud pumps, the derrick or mast, the drawworks, the rotary table or topdrive, the drillstring, the power generation equipment and auxiliary equipment.

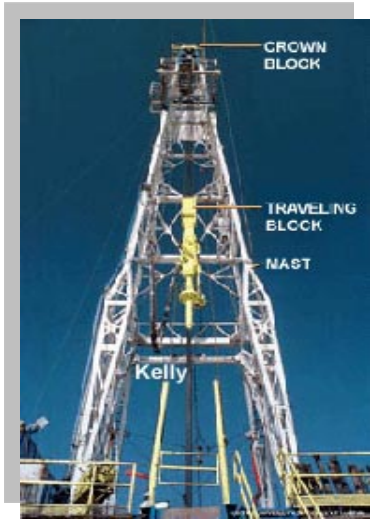


Mast:

Mast is a portable derrick capable of being erected as a unit, as distinguished from a standard derrick, which cannot be raised to a working position as a unit.

This structure used to support the crown blocks and the drillstring. Masts are usually rectangular or trapezoidal in shape and offer a very good stiffness, important to land rigs whose mast is laid down when the rig is moved. They suffer from being heavier than conventional derricks and consequently are not usually found in offshore environments, where weight is more of a concern than in land operations.





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√General

Hoisting equipment

Rotation equipment

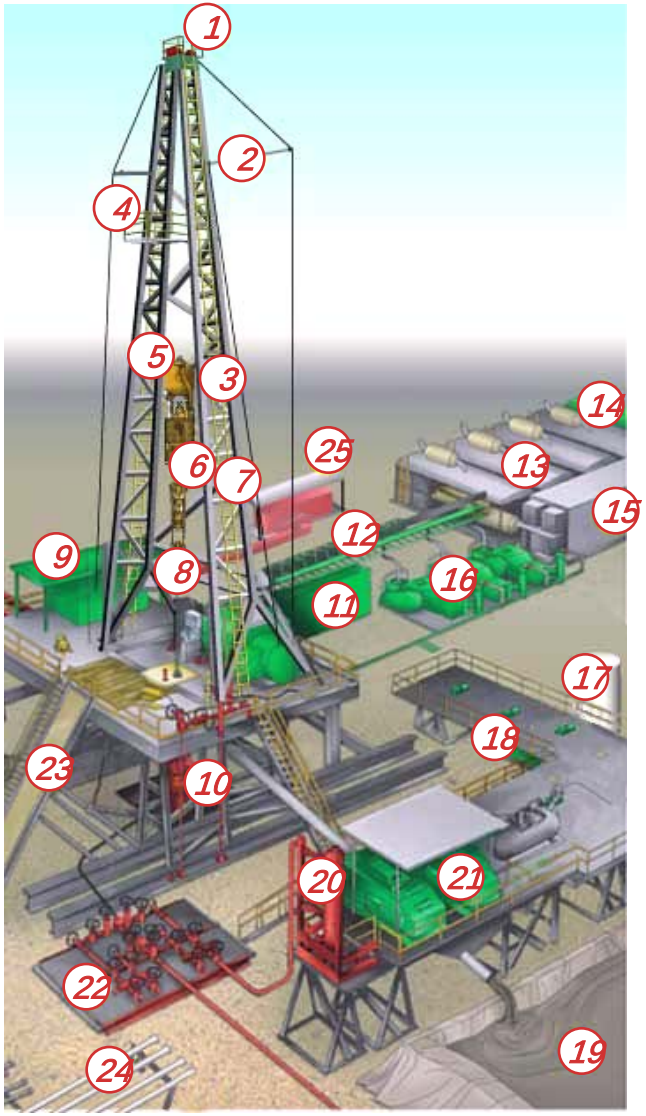
Mud circulation equipment

Drill pipe & BHA

Safety equipment

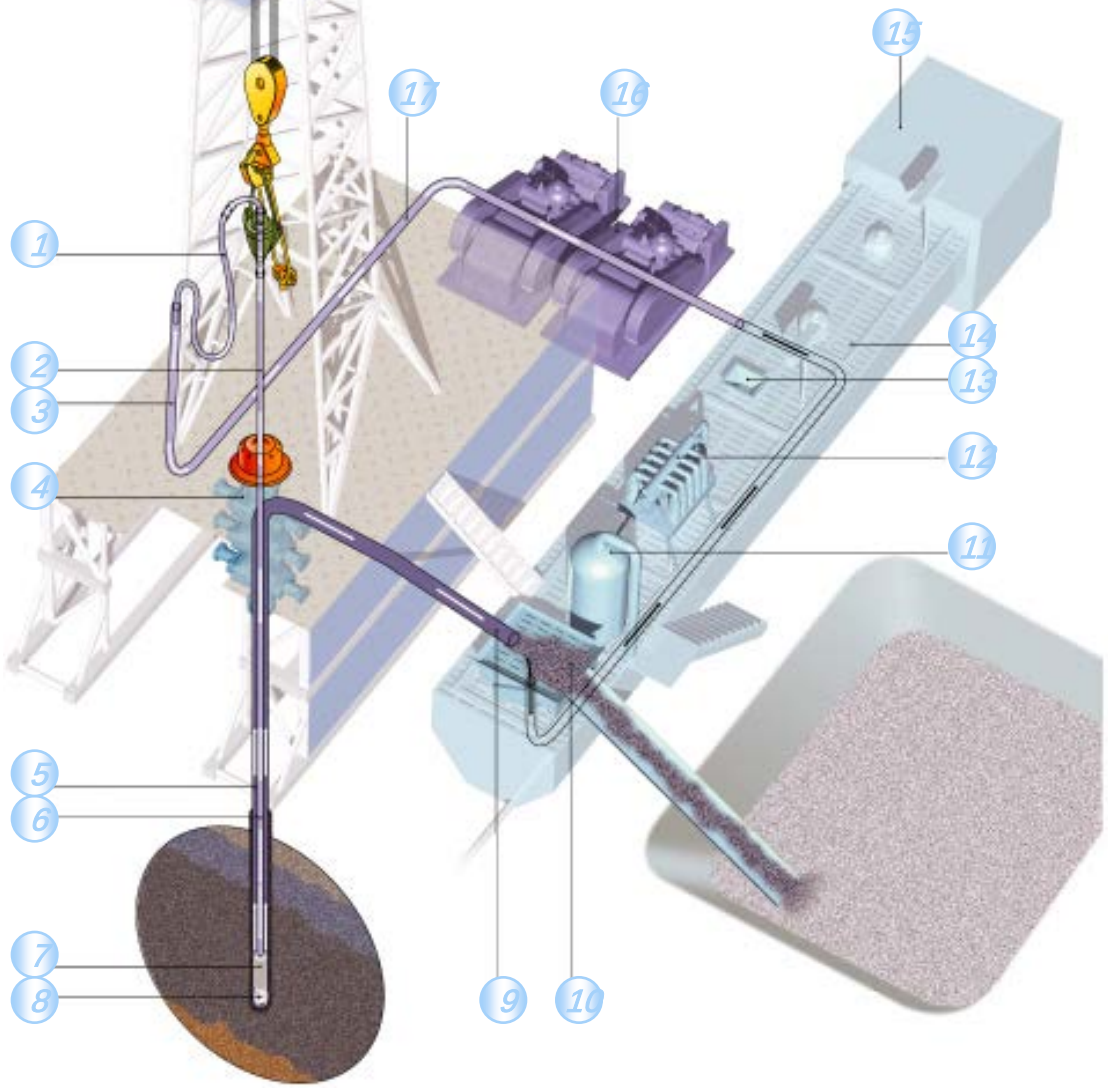
Rig facilities

1. Crown Block and Water Table
2. Catline Boom and Hoist Line
3. Drilling Line
4. Monkeyboard
5. Traveling Block
6. Top Drive
7. Mast
8. Drill Pipe
9. Doghouse
10. Blowout Preventer
11. Water Tank
12. Electric Cable Tray
13. Engine Generator Sets
14. Fuel Tank
15. Electrical Control House
16. Mud Pumps
17. Bulk Mud Component Tanks
18. Mud Tanks (Pits)
19. Reserve Pit
20. Mud-Gas Separator
21. Shale Shakers
22. Choke Manifold
23. Pipe Ramp
24. Pipe Racks
25. Accumulator

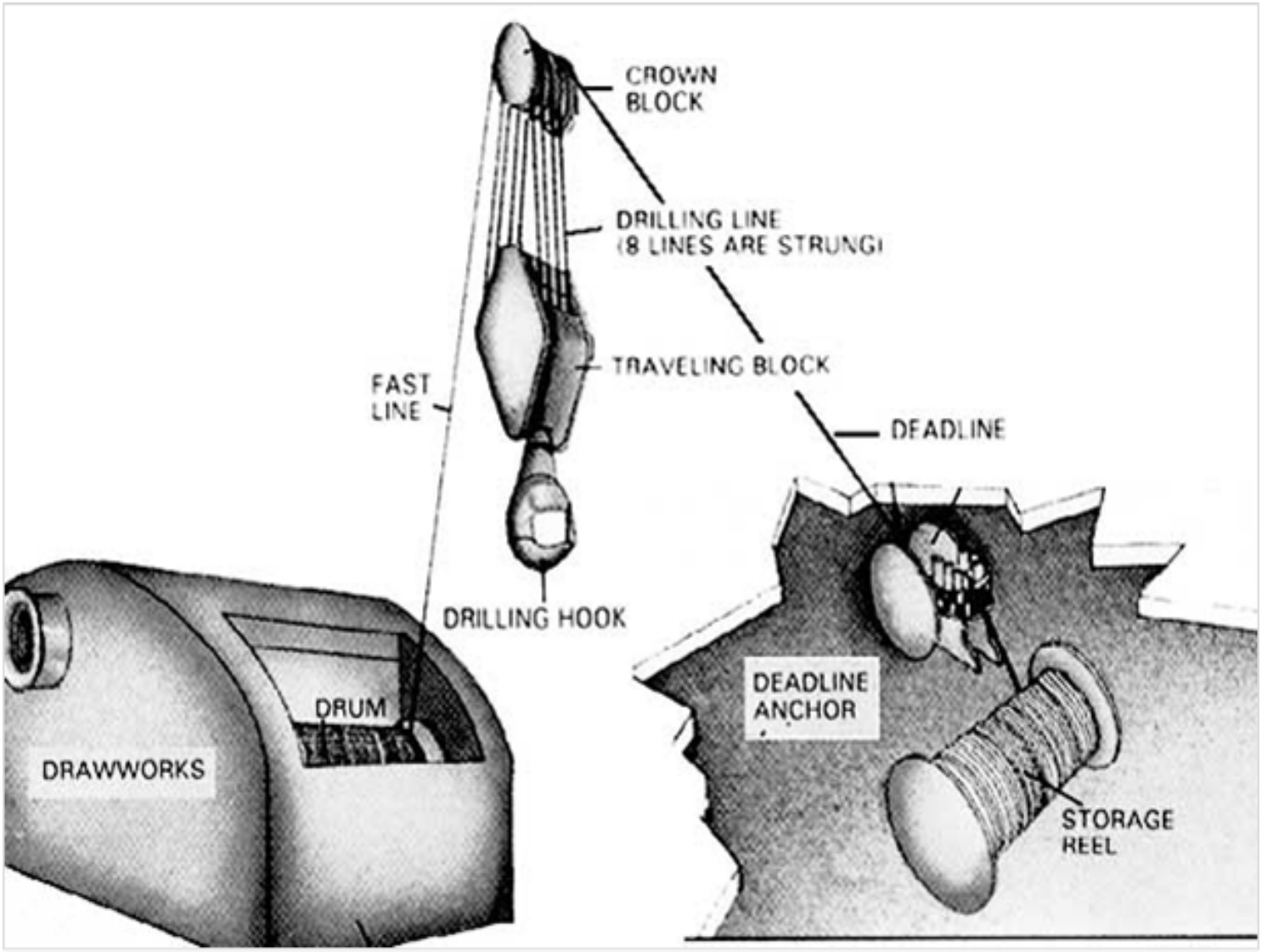


Mud Circulating System:

- Hose
- Kelly
- Stand pipe
- BOP
- Annulus
- Drillpipes
- Drill collars
- Drill bit
- Return line
- Shale shaker
- Seprator
- Desilter
- Mud mixer
- Mud tanks
- Mud-mixing Shake
- Mud pumps
- Discharge line

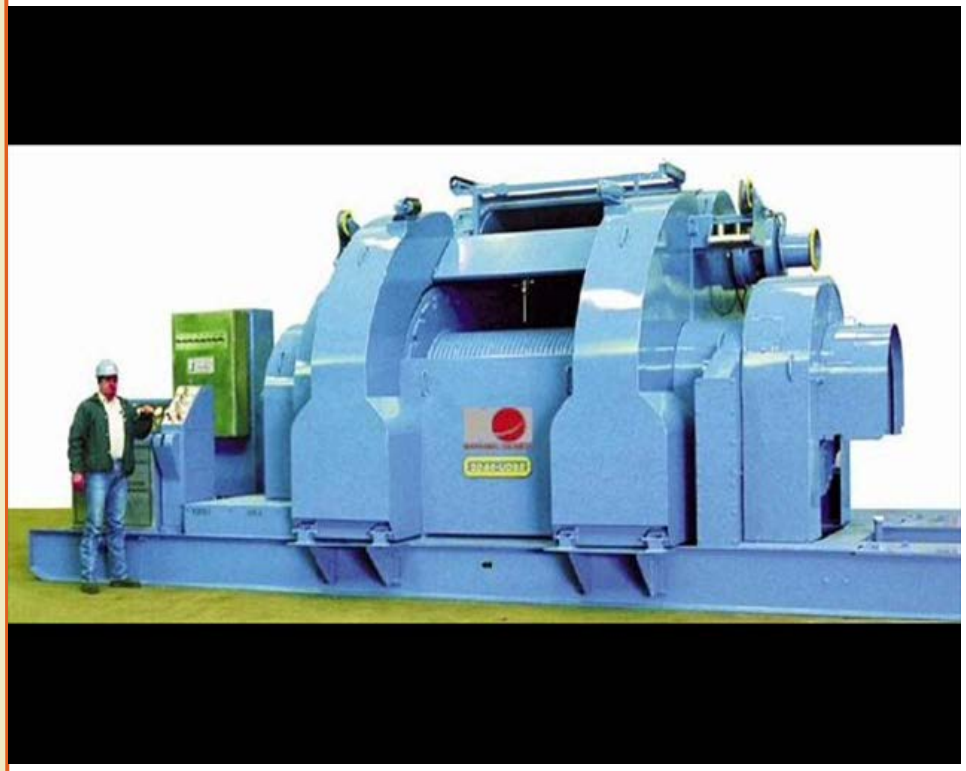


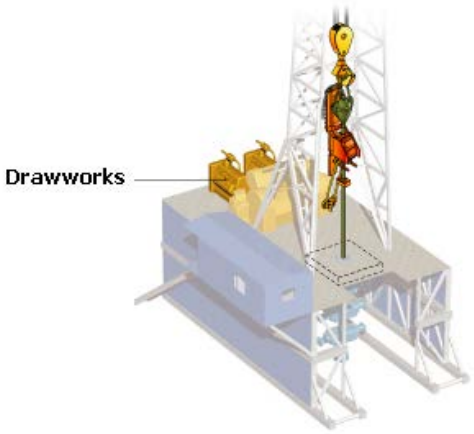
- Hoisting system



Drawworks:

The machine on the rig consisting of a large-diameter steel spool, brakes, a power source and assorted auxiliary devices. The primary function of the drawworks is to reel out and reel in the drilling line, a large diameter wire rope, in a controlled fashion. The reeling out of the drilling line is powered by gravity and reeling in by an electric motor or diesel engine.

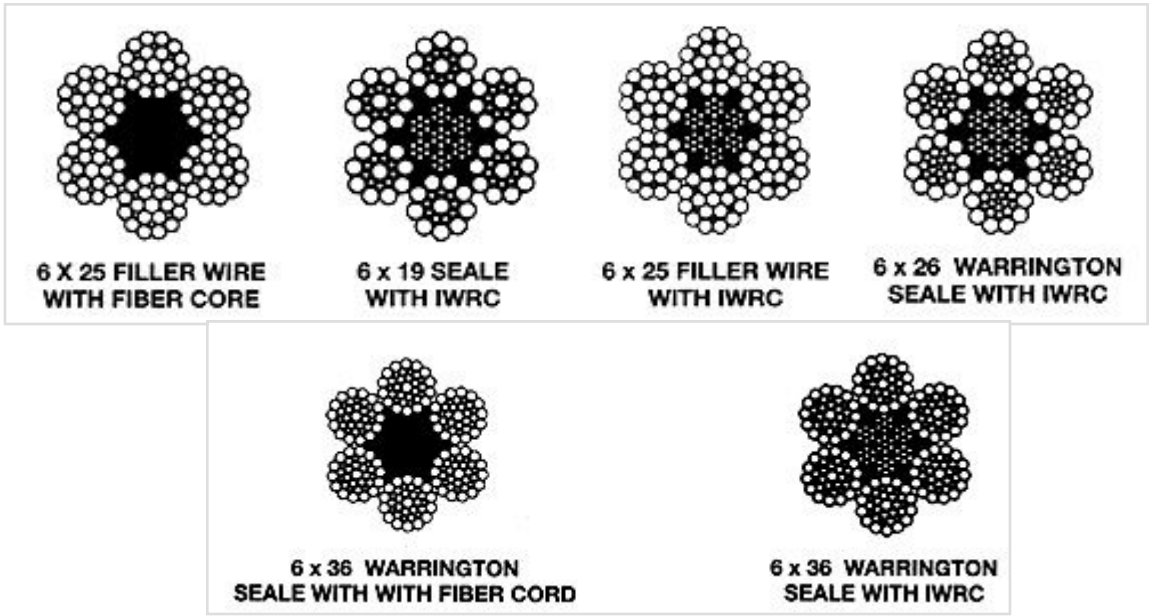


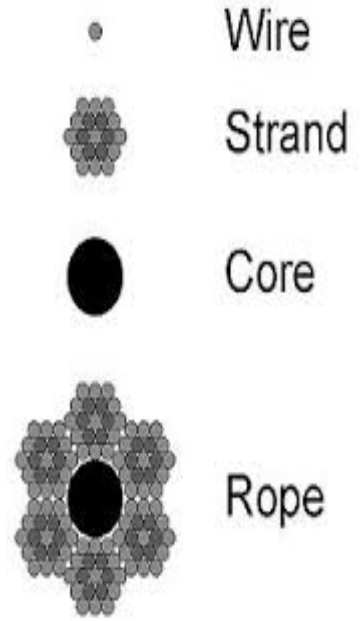


Drilling Line

The wire rope used to support the Drilling Tools.

Type of Wire Rope Construction



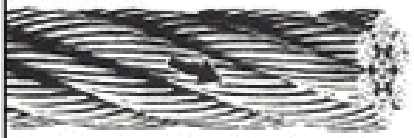
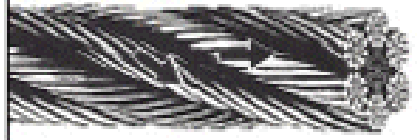


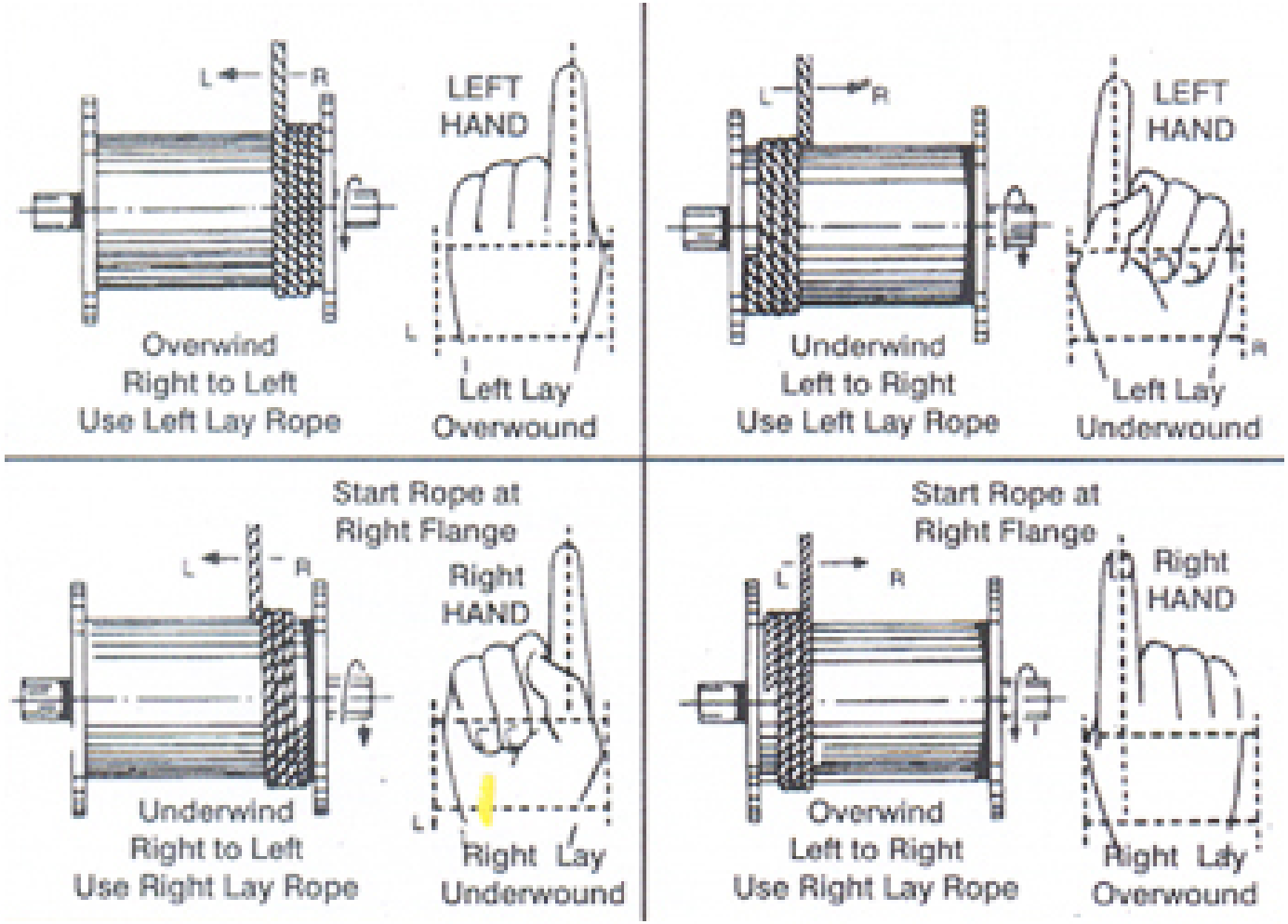
ENTER

Drilling Line

Typically the wire rope used for Drilling Line would have the following characteristics:

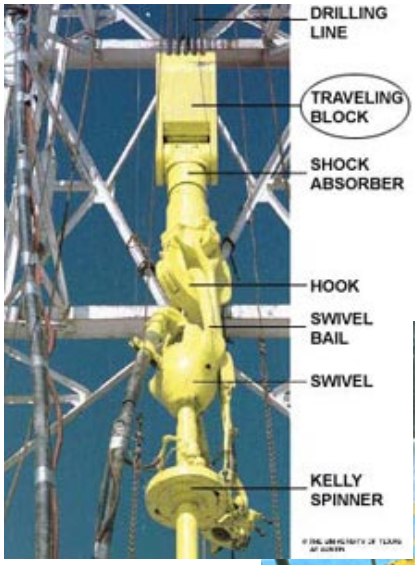
Shallow:	*1" to 1-1/8" diameter*
Deep:	*1-1/4" to 2" diameter*
Contruction:	*6 x 19 S or 6 x 21 S or 6 x 25 FW, IPS or EIP, IWRC*

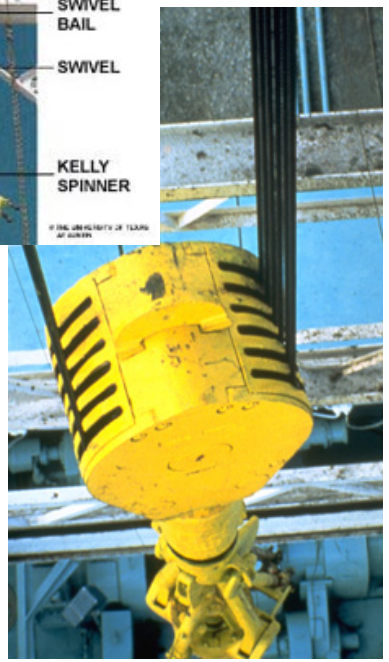
Wire Rope Lay	Definition	Characteristics
Regular Lay 	Most common lay in which the wires wind in one direction and the strands the opposite direction. (right lay shown)	Less likely to kink and untwist; easier to handle; more crush resistant than lang lay.
Lang Lay 	Wires in strand and strands of rope wind the same direction. (right lay shown)	Increased resistance to abrasion; greater flexibility and fatigue resistance than regular lay; will kink and untwist.
Right Lay 	Strands wound to the right around the core. (regular lay shown)	The most common construction.
Left Lay 	Strands wound to the left around the core. (regular lay shown)	Not generally used with construction equipment.
Alternate Lay 	Alternate strands of right regular lay and right lang lay.	Combines the best features of regular and lang lay for boom hoist or winch lines.



Travelling block:

The set of sheaves that move up and down in the derrick. The wire rope threaded through them is threaded (or "reeved") back to the stationary crown blocks located on the top of the derrick. This pulley system gives great mechanical advantage to the action of the wire rope drilling line, enabling heavy loads (drillstring, casing and liners) to be lifted out of or lowered into the wellbore.





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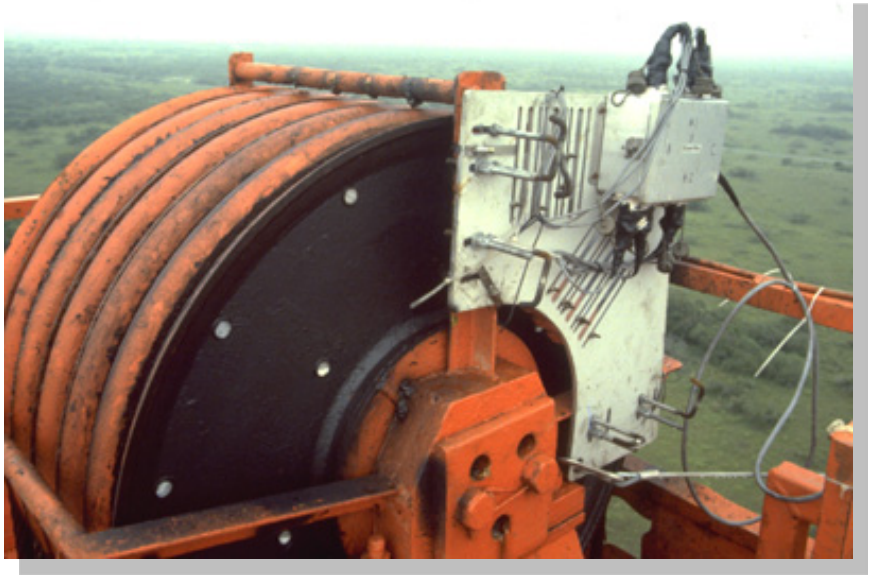
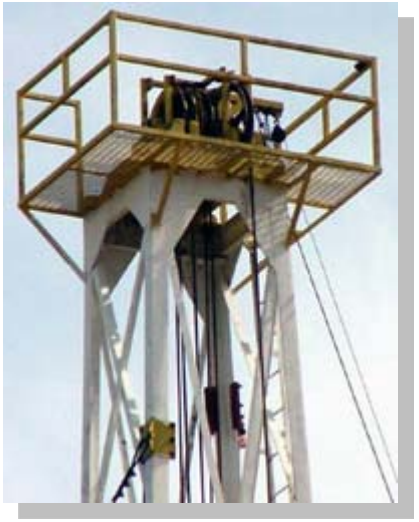
Crown block:

The fixed set of pulleys (called sheaves) located at the top of the derrick or mast, over which the drilling line is threaded. The companion blocks to these pulleys are the traveling blocks. By using two sets of blocks in this fashion, great mechanical advantage is gained, enabling the use of relatively small drilling line (3/4 to 1 1/2 in. diameter steel cable) to hoist loads many times heavier than the cable could support as a single strand.





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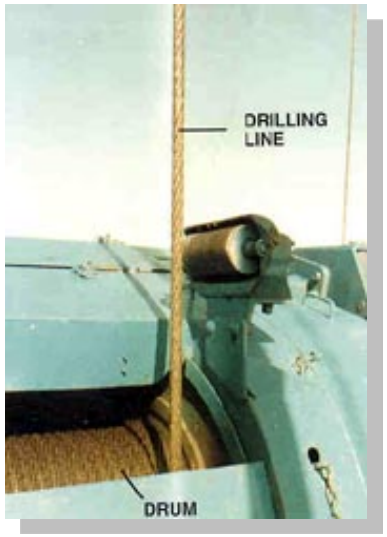
Hook:

The high-capacity J-shaped equipment used to hang various other equipment, particularly the swivel and kelly, the elevator bails or topdrive units. The hook is attached to the bottom of the traveling block and provides a way to pick up heavy loads with the traveling block. The hook is either locked (the normal condition) or free to rotate, so that it may be mated or decoupled with items positioned around the rig floor, not limited to a single direction.

Back

Drilling line:

A wire rope hoisting line, reeved on sheaves of the crown block and traveling block (in effect a block and tackle). Its primary purpose is to hoist or lower drill pipe or casing from or into a well. Also, a wire rope used to support the drilling tools.



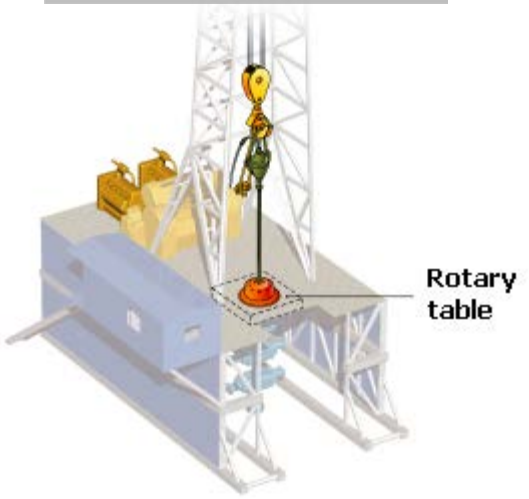
Elevator:

A set of clamps that grips a stand, or column, of casing, tubing, drill pipe, or sucker rods, so the stand can be raised or lowered into the hole.

Rotary table:

The revolving or spinning section of the drillfloor that provides power to turn the drillstring in a clockwise direction. The rotary motion and power are transmitted through the kelly bushing and the kelly to the drillstring. Almost all rigs today have a rotary table, either as primary or backup system for rotating the drillstring.

Topdrive technology, which allows continuous rotation of the drillstring, has replaced the rotary table in certain operations. A few rigs are being built today with topdrive systems only, and lack the traditional kelly system.



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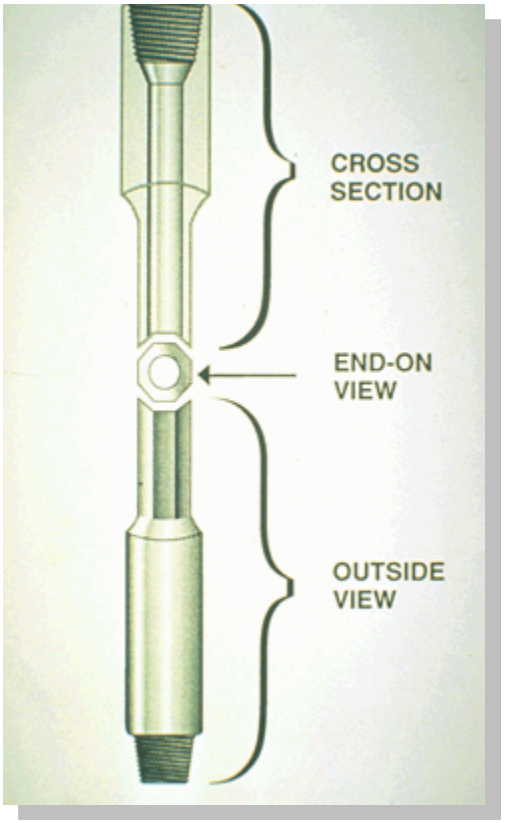
Kelly:

A long square or hexagonal steel bar with a hole drilled through the middle for a fluid path. The kelly is used to transmit rotary motion from the rotary table or kelly bushing to the drillstring, while allowing the drillstring to be lowered or raised during rotation. The kelly goes through the kelly bushing, which is driven by the rotary table. The kelly bushing has an inside profile matching the kelly's outside profile (either square or hexagonal), but with slightly larger dimensions so that the kelly can freely move up and down inside.

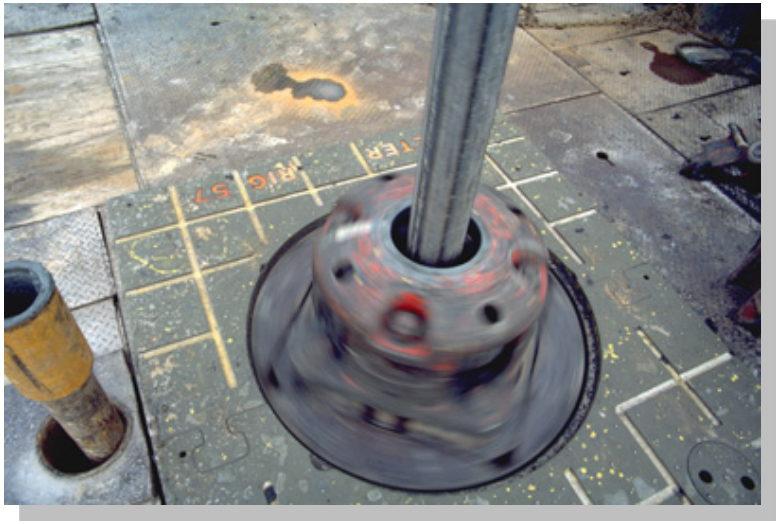


The kelly transfers rotary motion from the rotary table or kelly bushing to the drillstring. The upper diagram shows the interior fluid path. The middle diagram shows the hexagonal cross section. The lower diagram shows the outside view of the kelly.

Back

Kelly bushing:

An adapter that serves to connect the rotary table to the kelly. The kelly bushing has an inside diameter profile that matches that of the kelly, usually square or hexagonal. It is connected to the rotary table by four large steel pins that fit into mating holes in the rotary table. The rotary motion from the rotary table is transmitted to the bushing through the pins, and then to the kelly itself through the square or hexagonal flat surfaces between the kelly and the kelly bushing. The kelly then turns the entire drillstring because it is screwed into the top of the drillstring itself. Depth measurements are commonly referenced to the KB, such as 8327 ft KB, meaning 8327 feet below the kelly bushing.



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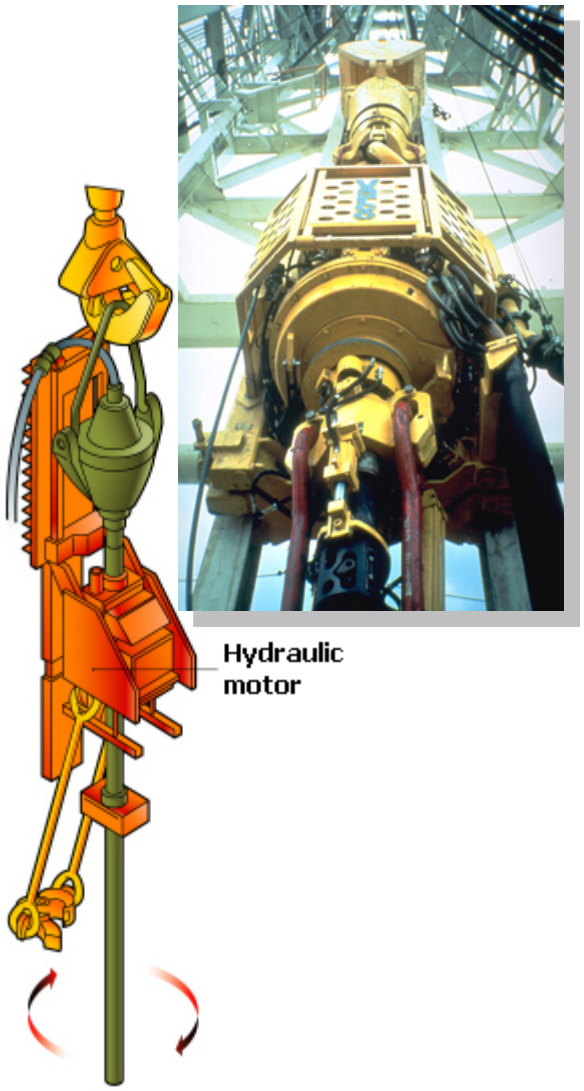
Topdrive:

A device that turns the drillstring. This is radically different from the more conventional rotary table and kelly method of turning the drillstring because it enables drilling to be done with three joint stands instead of single joints of pipe. It also enables the driller to quickly engage the pumps or the rotary while tripping pipe, which cannot be done easily with the kelly system. While not a panacea, modern topdrives are a major improvement to drilling rig technology and are a large contributor to the ability to drill more difficult extended-reach wellbores. In addition, the topdrive enables drillers to minimize both frequency and cost per incident of stuck pipe.



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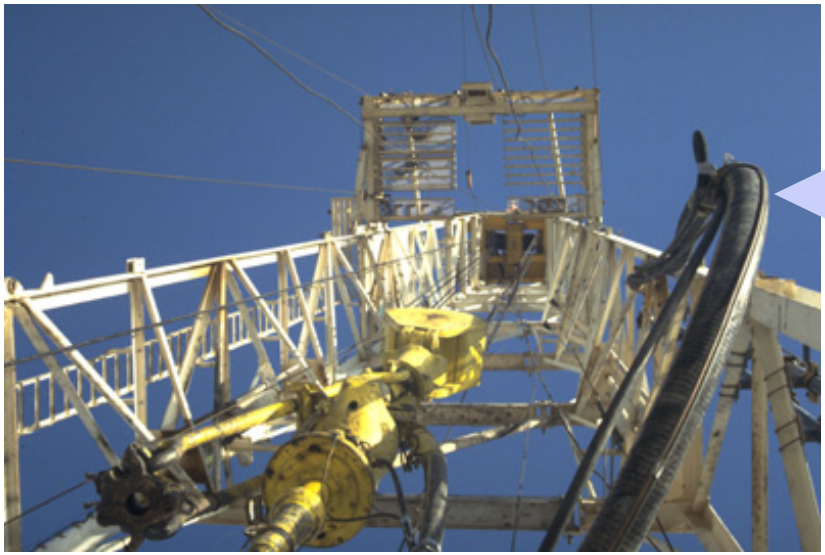
Swivel:

A mechanical device that must simultaneously suspend the weight of the drillstring, provide for rotation of the drillstring beneath it while keeping the upper portion stationary, and permit high-volume flow of high-pressure drilling mud from the fixed portion to the rotating portion without leaking.

Back

Kelly hose:

A large-diameter (3- to 5-in. inside diameter), high-pressure flexible line used to connect the standpipe to the swivel. This flexible piping arrangement permits the kelly (and, in turn, the drillstring and bit) to be raised or lowered while drilling fluid is pumped through the drillstring. The simultaneous lowering of the drillstring while pumping fluid is critical to the drilling operation.



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Mud Pump

A large, reciprocating pump used to circulate the mud on a drilling rig. A typical mud pump is a double- or triple-acting, two- or three-cylinder piston pump whose pistons travel in replaceable liners and are driven by a crankshaft actuated by an engine. A mud pump also is called a slush pump.

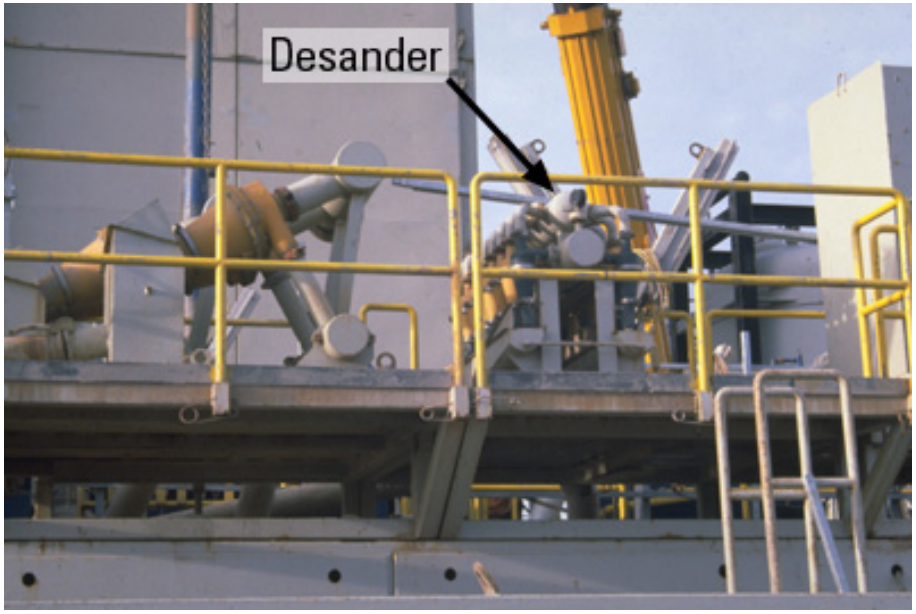
Bulk Mud Components in Storage

Hopper type tanks for storage of drilling fluid components.

Back

Desander:

A hydrocyclone device that removes large drill solids from the whole mud system. The desander should be located downstream of the shale shakers and degassers, but before the desilters or mud cleaners.Various size desander and desilter cones are functionally identical, with the size of the cone determining the size of particles the device removes from the mud system.



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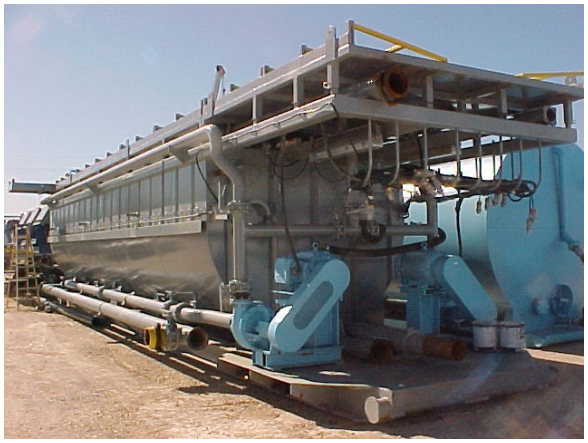
Shale shaker:

The primary and probably most important device on the rig for removing drilled solids from the mud. A wire-cloth screen vibrates while the drilling fluid flows on top of it. The liquid phase of the mud and solids smaller than the wire mesh pass through the screen, while larger solids are retained on the screen and eventually fall off the back of the device and are discarded.
Where it was once common for drilling rigs to have only one or two shale shakers, modern high-efficiency rigs are often fitted with four or more shakers.

Back

Mud pit:

A large tank that holds drilling fluid on the rig or at a mud-mixing plant. For land rigs, most mud pits are rectangular steel construction, with partitions that hold about 200 barrels each. They are set in series for the active mud system. On most offshore rigs, pits are constructed into the drilling vessel and are larger, holding up to 1000 barrels. Circular pits are used at mixing plants and on some drilling rigs to improve mixing efficiency and reduce dead spots that allow settling. Earthen mud pits were the earliest type of mud pit, but environmental protection concern has led to less frequent use of open pits in the ground. Today, earthen pits are used only to store used or waste mud and cuttings prior to disposal and remediation of the site of the pit.



Mud House: *The place where mud additives are kept at the rig, also known as the sack room.*

Back

Reserve Pits:

A mud pit in which a supply of drilling fluid has been stored. Also, a waste pit, usually an excavated, earthen-walled pit. It may be lined with plastic to prevent soil contamination.

Mud Gas Separator:

A device that removes gas from the mud coming out of a well when a kick is being circulated out.

Back

Desilterer:

A hydrocyclone much like a desander except that its design incorporates a greater number of smaller cones. As with the desander, its purpose is to remove unwanted solids from the mud system. The smaller cones allow the desilter to efficiently remove smaller diameter drill solids than a desander does. For that reason, the desilter is located downstream from the desander in the surface mud system.

Back

Flowline (mud return line):

The large-diameter metal pipe that connects the bell nipple under the rotary table to the possum belly at the mud tanks. The flowline is simply an inclined, gravity-flow conduit to direct mud coming out the top of the wellbore to the mud surface-treating equipment. When drilling certain highly reactive clays, called "gumbo," the flowline may become plugged and require considerable effort by the rig crew to keep it open and flowing. In addition, the flowline is usually fitted with a crude paddle-type flow-measuring device commonly called a "flow show" that may give the driller the first indication that the well is flowing.

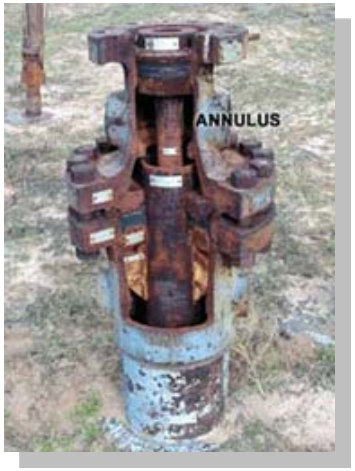
Back

Stand pipe:

A rigid metal conduit that provides the high-pressure pathway for drilling mud to travel approximately one-third of the way up the derrick, where it connects to a flexible high-pressure hose (kelly hose). Many large rigs are fitted with dual standpipes so that downtime is kept to a minimum if one standpipe requires repair.

Annulus:

The space around a pipe in a well bore, the outer wall of which may be the wall of either the bore hole or the casing; sometimes termed the annular space.



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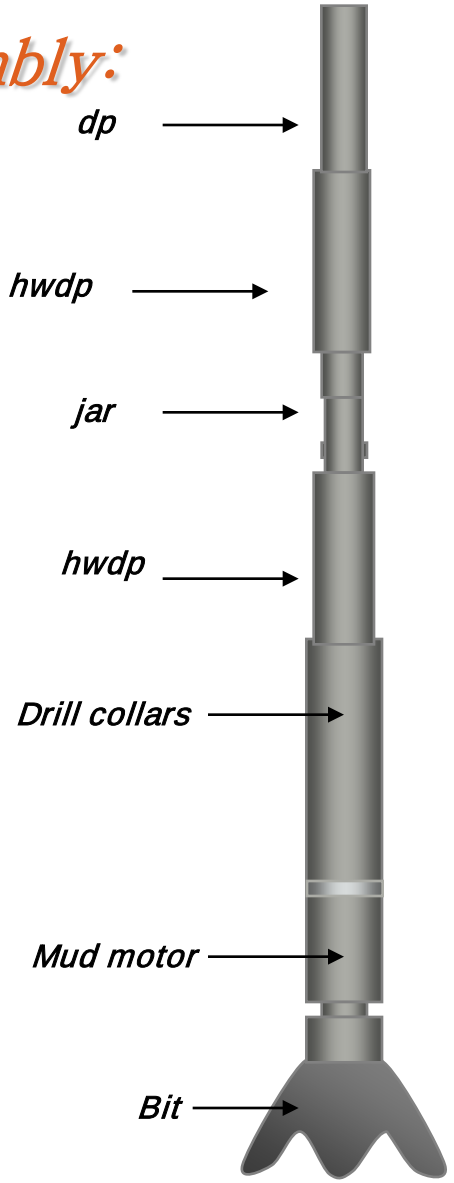
Bottom hole assembly:

The lower portion of the drillstring, consisting of (from the bottom up in a vertical well) the bit, bit sub, a mud motor (in certain cases), stabilizers, drill collars, heavy-wall drillpipe, jarring devices ("jars") and crossovers for various threadforms. Oftentimes the assembly includes a mud motor, directional drilling and measuring equipment, measurements-while-drillingtools, logging-while-drilling tools and other specialized devices. A simple BHA consisting of a bit, various crossovers, and drill collars may be relatively inexpensive (less than $100,000 US in 1999), while a complex one may cost ten or more times that amount.



Rotary Drill Bits:

*Rotary drilling bits usually are classified according to their design as "**Fixed cutter bits(Drag bits)**" and "**Rolling cutter bits**".*

Fixed cutter bits:

- **PDC(Polycrystalline Diamond Compact) bit:**

A drilling tool that uses polycrystalline diamond compact (PDC) cutters to shear rock with a continuous scraping motion. These cutters are synthetic diamond disks about 1/8-in. thick and about 1/2 to 1 in. in diameter. PDC bits are effective at drilling shale formations, especially when used in combination with oil-base muds.

Rotary Drill Bits:

Rolling cutter bits (Roller-cone bits):

A tool designed to crush rock efficiently while incurring a minimal amount of wear on the cutting surfaces. As the drillstring is rotated, the bit cones roll along the bottom of the hole in a circle. As they roll, new teeth come in contact with the bottom of the hole, crushing the rock immediately below and around the bit tooth. As the cone rolls, the tooth then lifts off the bottom of the hole and a high-velocity fluid jet strikes the crushed rock chips to remove them from the bottom of the hole and up the annulus.There are to types of roller-cone bits:

- ***Steel insert bits:***
  Application for soft formations

- ***Carbide insert bits:***
  Application for hard formations

Back

Drill Collar:

A component of a drillstring that provides weight on bit for drilling. Gravity acts on the large mass of the collars to provide the downward force needed for the bits to efficiently break rock.

Drill pipe:

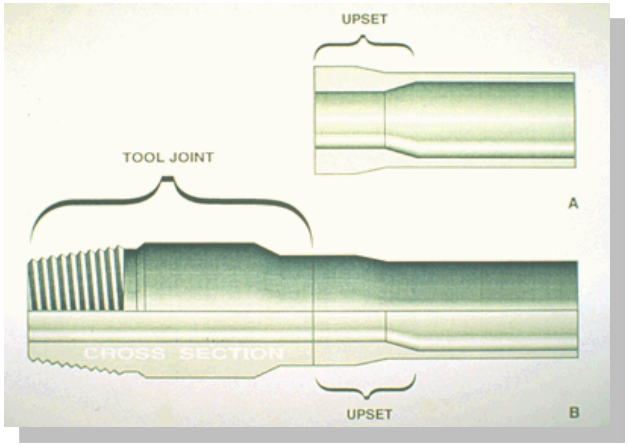
Drill pipe is a tubular steel conduit fitted with special threaded ends called tool joints. The drillpipe connects the rig surface equipment with the bottomhole assembly and the bit, both to pump drilling fluid to the bit and to be able to raise, lower and rotate the bottomhole assembly and bit.

TENSILE REQUIREMENTS

GRADE	YIELD STRENGTH		TENSILE STRENGTH
	MIN. PSI	MAX. PSI	MINIMUM PSI
D*	55,000	—	95,000
E	75,000	105,000	100,000
X-95	95,000	125,000	105,000
G-105	105,000	135,000	115,000
S-135	135,000	165,000	145,000

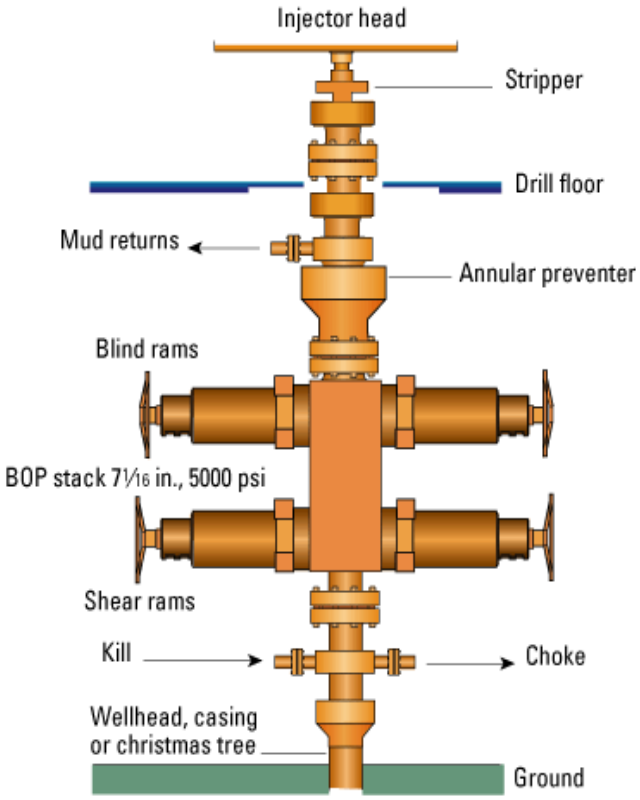
Tool Joint:

The enlarged and threaded ends of joints of drillpipe. These components are fabricated separately from the pipe body and welded onto the pipe at a manufacturing facility. The tool joints provide high-strength, high-pressure threaded connections that are sufficiently robust to survive the rigors of drilling and numerous cycles of tightening and loosening at threads. Tool joints are usually made of steel that has been heat treated to a higher strength than the steel of the tube body. The large-diameter section of the tool joints provides a low stress area where pipe tongs are used to grip the pipe. Hence, relatively small cuts caused by the pipe tongs do not significantly impair the strength or life of the joint of drillpipe.



Blowout preventer (BOP):

A large valve at the top of a well that may be closed if the drilling crew loses control of formation fluids. By closing this valve (usually operated remotely via hydraulic actuators), the drilling crew usually regains control of the reservoir, and procedures can then be initiated to increase the mud density until it is possible to open the BOP and retain pressure control of the formation. BOPs come in a variety of styles, sizes and pressure ratings. Some can effectively close over an open wellbore, some are designed to seal around tubular components in the well (drillpipe, casing or tubing) and others are fitted with hardened steel shearing surfaces that can actually cut through drillpipe.



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Choke Manifold

The arrangement of piping and special valves, called chokes, through which drilling mud is circulated when the blowout preventers are closed to control the pressures encountered during a kick.

Accumulator:

The storage device for nitrogen pressurized hydraulic fluid, which is used in operating the blowout preventers.

Catline Boom and Hoist Line:

A structural framework erected near the top of the derrick for lifting material.

Pipe Ramp

An angled ramp for dragging drill pipe up to the drilling platform or bringing pipe down off the drill platform.

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Monkeyboard:

The derrickman's working platform. Double board, tribble board, fourable board; a monkey board located at a height in the derrick or mast equal to two, three, or four lengths of pipe respectively.

Doghouse:

A small enclosure on the rig floor used as an office for the driller or as a storehouse for small objects. Also, any small building used as an office or for storage.

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Electric cable tray

Supports the heavy electrical cables that feed the power from the control panel to the rig motors.

Engine Generator Sets

A diesel, Liquefied Petroleum Gas (LPG), natural gas, or gasoline engine, along with a mechanical transmission and generator for producing power for the drilling rig. Newer rigs use electric generators to power electric motors on the other parts of the rig.

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Fuel tanks

Fuel storage tanks for the power generating system.

Electric Control House

On diesel electric rigs, powerful diesel engines drive large electric generators. The generators produce electricity that flows through cables to electric switches and control equipment enclosed in a control cabinet or panel. Electricity is fed to electric motors via the panel.

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Pipe Racks:

A horizontal support for tubular goods.

Water tank

Is used to store water that is used for mud mixing, cementing, and rig cleaning.

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Slips:

A device used to grip the drillstring in a relatively nondamaging manner and suspend it in the rotary table. This device consists of three or more steel wedges that are hinged together, forming a near circle around the drillpipe. On the drillpipe side (inside surface), the slips are fitted with replaceable, hardened tool steel teeth that embed slightly into the side of the pipe. The outsides of the slips are tapered to match the taper of the rotary table.

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Tong:

The large wrenches used for turning when making up or breaking out drill pipe, casing, tubing, or other pipe; variously called casing tongs, rotary tongs, and so forth according to the specific use. Power tongs are pneumatically or hydraulically operated tools that spin the pipe up and, in some instances, apply the final makeup torque.

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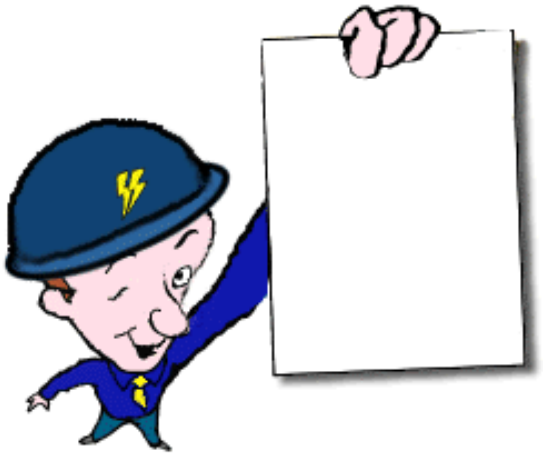

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